Design and implementation of Airborne Polarization Crossfire System

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Polarization Crossfire is to use the polarization sensor with different characteristics on the same observation platform to detect the same target by remote sensing, and acquire high-precision spectral, polarization and multi-angle information simultaneously. In theory, complementary advantages can be achieved by fusion inversion, and thus obtain data products with higher precision and quality [1]. Based on this idea, a Polarization Crossfire Aviation Verification System was built and the flight verification test was carried out. The system is equipped with a Particulate Observing Scanning Polarimeter (POSP) and a Three-beam Simultaneous Polarization Camera (TSPC). High-precision aerosol synthesis parameters are obtained by parameter transfer and cross-calibration. POSP adopts a simultaneous polarization measurement scheme combining aperture-divided and division-of-amplitude. Through in-orbit radiation and polarization calibration, high-precision polarization data of nine wavelengths from ultraviolet to short-wave infrared can be obtained. The TSPC uses a beam splitting prism and three linear polarizers to project the target scene onto the three area array detectors, and simultaneously acquires the high resolution polarization intensity image of the detected object in three polarization directions. In this essay, the principle and system structure of Polarization Crossfire detection are introduced, the spatial response matching issue introduced by the different working modes of the two instruments and its processing scheme were analyzed in detail. According to the working mode and spatial response characteristics of the dual-polarization instrument, the test scheme of aviation flight calibration is developed and the airborne polarization radiation measurement data is obtained. The results show that the polarization radiation data obtained by the two polarization instruments have good consistency, and pixel matching algorithm can transmit the accuracy of POSP to TSPC, realize the fusion of observation data of dual-polarization remote sensor, which verifies the feasibility of Polarization Crossfire detection, and provides a basis for the design of space-borne Polarization Crossfire detection system, data preprocessing, inversion method and process.

Reference

[1] McCorkel, J., B. Cairns, and A. Wasilewski, 2016: Imager-to-radiometer in-flight cross calibration: RSP radiometric comparison with airborne and satellite sensors. *Atmos. Meas. Tech.* **9**, 955–962.

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